federal register

WEDNESDAY, OCTOBER 16, 1974

WASHINGTON, D.C.

Volume 39 ■ Number 201

PART II

ENVIRONMENTAL PROTECTION AGENCY

■

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Copper, Zinc, and Lead Smelters

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 272-2]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Copper, Zinc and Lead Smelters

Pursuant to section 111 of the Clean Air Act, as amended, the Administrator proposes herein standards of performance for new and modified sources within three categories of stationary sources: (1) primary copper smelters, (2) primary zinc smelters, and (3) primary lead smelters. The Administrator also proposes amendments to Appendix A, Reference Methods, of 40 CFR Part 60.

As prescribed by section 111, this proposal of the standards was preceded by the Administrator's determination that these three categories of sources contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare and by his publication of a list of these categories of sources in this issue of the FEDERAL REGISTER. In accordance with section 117 of the Act, publication of these proposed standards was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. The Administrator will welcome comments on all aspects of the proposed regulations, including economic and technological issues, and on the proposed test method. All relevant comments received on or before December 2, 1974 will be considered. Comments received will be available for public inspection at the Office of Public Affairs, 401 M Street, SW, Washington, D.C. 20460.

The background materials on the standards of performance proposed herein have been published in a report entitled *Background Information for New Source Performance Standards: Primary Copper, Zinc, and Lead Smelters, Volume 1, Proposed Standards* (EPA-450/2-74-002-a). This report is too voluminous to publish in the FEDERAL REGISTER; copies are available on request from the Emission Standards and Engineering Division, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. The information contained in this report is briefly discussed below.

The bases for the proposed standards include a very extensive survey of the nonferrous smelting industry, including foreign smelting technology, plus the results of emission tests conducted by EPA. In each case, the proposed standards reflect the degree of emission reduction achievable through the application of the best system of emission reduction which, taking into account the cost of achieving such reduction, the Administrator has determined has been adequately demonstrated. It is emphasized that the costs are considered reasonable for new and modified sources and that it is not implied that the same costs apply to the retrofitting of existing sources. Retrofitting existing sources to achieve the proposed standards would, in some cases, cost much more.

As discussed in the background information report, primary copper, zinc, and lead smelters are significant sources of particulate matter and sulfur dioxide (SO_2). The standards proposed for these smelters apply to all process gas streams which have been identified as major sources of particulate matter and SO_2, and for which control technology (considering costs) has been demonstrated. The following affected facilities are specified by the proposed standards:

Primary copper smelters—Dryer Roaster, Smelting furnance, Converter.
Primary zinc smelters—Roasters, Sintering machine.
Primary lead smelters—Sintering machine, Sintering machine discharge end, Blast furnace, Dross reverberatory furnace, Electric smelting furnace, Converter.

GENERAL RATIONALE

Primary smelters discharge both strong SO_2 streams, which contain SO_2 in concentrations greater than 3.5 to 4.0 percent, and weak SO_2 streams, which contain SO_2 in concentrations less than 3.5 percent. The characterization of effluents in terms of these SO_2 concentration levels depends upon the fact that conventional sulfuric acid plants of single absorption (SA) and double absorption (DA) design are economically operable only on streams more concentrated than 3.5 and 4.0 percent SO_2, respectively. Sulfuric acid plants are the primary SO_2 control equipment used by domestic smelters, but the smelting industry has announced plans to construct an elemental sulfur plant, as well as additional systems to produce liquid SO_2, for the control of strong SO_2 streams. Demonstrated control equipment for weak SO_2 streams is available, though this technology has been applied domestically only recently at one smelter, and this system is still undergoing startup. However, the detailed economic analysis contained in the background information report indicates that costs for controlling weak SO_2 streams are at this time so high that they cannot in most cases be reasonably imposed on the smelting industry.

The proposed standards for SO_2 require that control as effective as DA sulfuric acid plants be achieved. Even though 29 of the 31 acid plants which control domestic smelters are of SA design, a trend toward the use of DA plants has already been established by the startup of the first two domestic metallurgical DA plants within the past 18 months and by the initiation of construction or the announced plans for construction of three other DA facilities. DA acid plants discharge 70 to 80 percent less SO_2 than SA plants; typical SO_2 control efficiencies of SA and DA plants are, respectively, 97 percent and 99.5 percent. The capital investment for DA plants is about 15 percent greater than for SA plants, but the DA emission control costs are considered reasonable. Accordingly, the Administrator has determined that DA sulfuric acid plants are best demonstrated systems of emission reduction, considering cost, for strong SO_2 streams from smelters.

The SO_2 emission limitation prescribed by the proposed standards was initially based on EPA tests of SA sulfuric acid plants in combination with assessments by acid plant vendors of the emission control capabilities of DA acid plants. In the absence of domestic metallurgical DA acid plants during the early development of the proposed standards, and in recognition of the desirability of relating acid plant performance to domestic smelting practices, EPA initiated a testing program to characterize emissions from the best domestic metallurgical SA acid plants. The resulting data, including those from long-term continuous SO_2 monitoring of a SA acid plant which treated copper converter gases, provided information on the effects of gas stream fluctuations and acid plant catalyst deterioration on SO_2 emissions. During the later development of the proposed standards, after the first domestic metallurgical DA acid plant had achieved normal operation, EPA began a continuous SO_2 monitoring program at the facility. This monitoring provided the data which serve as the basis for the proposed SO_2 standards. Summaries of these test data and other emission test data collected by EPA during development of the proposed standards are included in the background information report.

Hydrometallurgical extraction processes, which largely eliminate the atmospheric release of SO_2 which is characteristic of pyrometallurgical processes, were considered in developing the proposed standards. A full-scale unit of the Anaconda - Arbiter hydrometallurgical copper extraction process is scheduled for startup in late 1974, but no hydrometallurgical process has to date been successfully commercialized for the treatment of copper, lead, or zinc sulfide ores. In the judgment of the Administrator, the range of applicability of the hydrometallurgical processes has not yet been sufficiently defined to consider basing emission standards solely on these processes.

A standard for visible emissions is proposed for sulfuric acid plants used as control devices to comply with the SO_2 standard. The purpose of this standard is to ensure: (1) that the acid plant is properly maintained and operated to minimize SO_2 emissions which would be converted into sulfuric acid mist in the atmosphere, and (2) that a high-efficiency mist eliminator is installed, maintained, and operated to collect sulfuric acid mist within the acid plant stack.

No particulate standards are proposed for affected facilities subject to an SO_2

standard because the proper operation of acid plants requires that, prior to SO_2 removal, particulate matter be removed to a degree consistent with best available particulate control technology.

PRIMARY COPPER SMELTERS

Fourteen of the existing fifteen domestic copper smelters operate reverberatory smelting furnaces which typically discharge 20–25 percent of the smelter input sulfur, as SO_2, in a weak SO_2 stream. The cost of controlling these emissions is not considered to be reasonable in most cases, as noted above and discussed in detail in the background information report. However, the Administrator has determined that two copper smelting processes which discharge only strong SO_2 streams (flash smelting and electric furnace smelting) are demonstrated smelting technologies and are together applicable to essentially the full range of domestic copper smelting operations. One electric copper smelting furnace is already in use in the U.S., and construction of a second electric furnace has just been completed. The construction of a flash furnace has been started.

The proposed standards require the equivalent of DA acid plant control of SO_2 for roasters, smelting furnaces, and converters at copper smelters. Since reverberatory furnaces emit a weak SO_2 stream and it is very costly to control such streams to meet the proposed standard for SO_2 emissions, it is expected that very few, if any, new reverberatory furnaces will be constructed in the near future. During the development of the proposed standards, the smelting industry expressed strong objections that the alternative flash and electric smelting processes have significant processing limitations. The industry claimed that electric furnace smelting, even though fully as flexible a production method as conventional reverberatory smelting processes now in use, will not be viable in some cases because of the non-availability of electric power. Although not widely practiced at this time, it is feasible to construct a new smelter operation and blend the effluent from a reverberatory furnace with the effluents from a roaster and converter; the combined effluent would be a strong SO_2 stream which could be controlled with a DA acid plant.

The industry also argued that a significant portion of domestically processed copper concentrates cannot be handled by flash furnaces, either because of an insufficient content of sulfur for fuel or an excessive content of lead, zinc or other volatile metals in the concentrates which would interfere with the operation of heat recovery facilities. EPA surveys show, as discussed in the background information report, that approximately 95 percent of domestic ore concentrates have sufficient sulfur, whereas 96 and 99 percent are sufficiently limited in lead and zinc, respectively, to permit the use of flash smelting. Further, the industry raised the point that the decreased capability of conventional flash smelters for eliminating impurities as effectively as reverberatory furnace smelters would result in the production, from those copper concentrates and smelter byproducts containing high levels of such impurities as arsenic, antimony, and bismuth, of anode copper too impure for conversion into quality electrolytic-grade copper. The levels of impurities at which this potential problem would be encountered and the quantities of domestic feed materials which would contain such levels of impurities are not well defined at this time. The industry has stated that the primary impact would be on custom smelters, which conventionally handle higher impurity materials than integrated mining-smelting-refining firms, but that even some custom smelters would be capable of using flash smelting without encountering excessive impurity problems. It has not been demonstrated that the levels of impurities are so high, in a relatively large proportion of domestically processed concentrates and smelting byproducts, as to cause a significant limitation in the use of the flash smelting process. Should increased impurity levels in flash smelting prove to be a problem at some smelters, however, a number of techniques for improved impurity elimination are available: (1) Power for an alternative electric smelter will certainly be available in some situations, and this process is free of the features that are associated with possible reduced impurity elimination in flash smelting; (2) If flash smelting is adopted, alterations in the conventional fire refining and electrolytic refining processes for blister copper are available and would permit an increased removal of impurities. The background information report contains a detailed description of these changes to refining operations; (3) The higher temperatures produced by oxygen enrichment of smelting furnaces or converters at flash smelters are indicative of increased volatilization and probably of increased impurity removal; and (4) Where both relatively clean and relatively impure feed materials are available, blending of materials is a method for effectively reducing the impurity level of the smelter charge.

The industry also pointed out that flash smelters are not capable of processing as large quantities of copper scrap and copper precipitates as conventional reverberatory furnace smelters. The recovery of scrap at primary copper smelters accounts for about 20 percent of domestically produced copper. EPA believes that if the adoption of flash smelting causes any reduction in the capability of primary copper smelters to process scrap, expansion will be encouraged in the domestic secondary copper smelting industry, which already furnishes about 15 percent of domestically produced copper. Primary copper smelters also manufacture about 15 percent of all domestically produced copper by processing copper precipitates, obtained by acid leaching of copper oxide and low-grade copper oxide/copper sulfide ores. EPA believes that if the adoption of flash smelting causes any reduction in the capability of primary copper smelters to recover copper from copper precipitates, expansion will be encouraged in the domestic electrowinning industry, which recovers copper from acid leaching solutions by an alternative process.

Most of the above industrial comments concerning limitations of flash smelters were raised during the latter stages of developing the proposed standards. EPA has subsequently funded a contract study which is intended to independently assess the available information concerning the technical limitations of flash smelters and the associated economic impact of the proposed standards. In the course of this investigation, the contractor will consult with experts on flash smelting technology and on domestic smelting practices. Further, the availability of electric power will be quantified to assess the extent to which electric smelting can be adopted by new copper smelters. The Administrator will consider the results of this study, together with comments submitted by interested persons on or before December 2, 1974, in determining whether the proposed standards should be revised prior to promulgation.

On the basis of information available at this time, the Administrator has determined that the flash and the electric furnace smelting processes, in conjunction with adequately demonstrated emission control systems, constitute the best systems of copper smelter sulfur dioxide emission reduction for new smelters, considering cost, which have been adequately demonstrated. The proposed particulate matter standard for dryers at copper smelters limits emissions to levels achievable with fabric filter control equipment. The visible emission standard specified for dryers is intended to require proper operation and maintenance of such equipment on a day-to-day basis, and not to require the use of a control system different from that required to comply with the particulate standard. The time exemption included in the visible emission standard accommodates higher opacities caused by periodic bag shaking.

At this time, it appears that a substantial amount of the increases in production of copper over the next few years will be accomplished through expansions at the existing primary copper smelters. In the Administrator's judgment, the cost of controlling sulfur dioxide emissions from existing reverberatory furnaces to meet the proposed standards is unreasonable; some exemption is therefore necessary to allow expansions of existing smelters at a reasonable cost. This is accomplished in the proposed sulfur dioxide standard of performance by permitting existing reverberatory smelting furnaces to be modified without meeting the proposed SO_2 standard, provided the total emissions discharged into the atmosphere from all the facilities at the smelter do not increase above levels allowed under implementation plans approved or promulgated under 40 CFR Part 52. The proposed exemption applies only to existing reverberatory smelting

furnaces; any modification of an existing roaster or converter will be subject to the standard of performance. A further exemption may be necessary on a case-by-case basis if an existing smelter has installed best available control technology on roasters and converters and an increase in total emissions from all facilities at the smelter resulting from a proposed modification of an existing reverberatory furnace cannot be avoided through a process change, blending of gas streams, or other control options.

Because of the complexity of the technical and economic issues concerning the proposed standard of performance for copper smelters, the Administrator urges all interested persons to submit factual data bearing on the issues discussed above, or any other issues pertaining to the proposed standard, during the comment period. In particular, comments are solicited on the extent to which it will be necessary to adopt electric furnace smelting to comply with the proposed standard, and on the economics and energy requirements of electric smelting.

Primary Zinc Smelters

In developing the proposed standards for emissions from primary zinc smelters, the Administrator has considered both the electrolytic zinc extraction process, which generates no weak SO_2 streams, and those pyrometallurgical processes which conventionally discharge a weak SO_2 stream from sintering machines. A discussion of demonstrated SO_2 control technology for weak and strong SO_2 streams is presented in the General Rationale. When roasting of zinc concentrates precedes sintering, as is the practice at each of the three domestic non-electrolytic zinc smelters, the sintering machine effluent typically contains 3 to 7 percent of the smelter input sulfur at a concentration of 400 to 3000 ppm SO_2. The cost of controlling the weak SO_2 stream from a sintering machine was considered unreasonable. The alternative of basing a standard solely on the electrolytic process produces higher purity, more expensive zinc than is required by many end uses (approximately 50 percent of U.S. zinc consumption). Some uses such as galvanizing even require the presence of impurities, and the application of electrolytically produced zinc would necessitate debasing the metal at an additional cost of 0.5 cent per pound of zinc. On the other hand, the non-electrolytic zinc smelting process accommodates the two major types of reduction furnaces which individually produce intermediate-grade zinc and the lower grade (prime western) zinc for end uses such as galvanizing.

The proposed standards for affected facilities at zinc smelters limit emissions of particulate matter from sintering machines to levels achievable with fabric filter control equipment. As noted above for the copper smelter standard, the visible emission standard specified for sintering machines is intended to require proper operation and maintenance of the control equipment required to comply with the particulate standard and includes a time exemption for higher opacities caused by bag shaking. No sulfur dioxide emission limitation is specified for sintering machines, but any sintering machine which emits more than 10 percent of the smelter input sulfur (as SO_2 will be subject to the same SO_2 standard as zinc roasters. This ensures that sintering machines which are operated simultaneously as roasters and which have been judged to be capable of generating strong SO_2 streams will be controlled to the level required on all other strong SO_2 streams. The proposed standards require the equivalent of DA acid plant control for zinc roasters.

Primary Lead Smelters

In developing the proposed standards for emissions from lead smelters, the Administrator has considered: (1) The conventional process that does not use sintering machine gas recirculation, (2) the similar process including sintering machine gas recirculation, and (3) the electric furnace-converter process. In the first process, the sintering machine effluent is either a single weak SO_2 stream, or a single strong SO_2 stream from the front end of the machine and a single weak SO_2 stream from the back end. If the sintering machine effluent is split, the weak SO_2 stream typically contains 20 percent of the smelter input sulfur. In the second process, gas recirculation permits the attainment of a single strong SO_2 stream from the sintering machine. Both of the first two processes discharge from blast furnaces a weak SO_2 stream containing approximately 7 percent of the smelter input sulfur at a gas stream concentration of 500 to 2500 ppm SO_2. The cost of controlling SO_2 in the blast furnace effluent was considered unreasonable. The third process, using an electric furnace and converters, is the only demonstrated lead smelting process which has been identified to be capable of eliminating all weak SO_2 streams. However, this process has to date been used only in a single foreign smelter, with no SO_2 control applied to the converters. Further, the electric furnace process has not yet handled concentrates containing less than 65 percent lead, and domestic concentrates typically contain 55 percent lead. In the judgment of the Administrator, it has not been demonstrated that the electric furnace process is of sufficiently broad applicability to justify basing the proposed standards solely on this process. However, the Administrator has determined that the proposed standards should be based on the generation of a strong SO_2 sintering machine discharge, thereby effectively requiring sintering machine gas recirculation. A discussion of demonstrated SO_2 control technology for weak and Strong SO_2 streams is presented above under General Rationale.

The proposed standards for affected facilities at lead smelters limit emissions of particulate matter from blast furnaces, dross reverberatory furnaces, and the discharge end of sintering machines to levels achievable with fabric filter control equipment. The visible emission standard specified for these affected facilities is intended, as noted above for the zinc smelter standard, to require proper operation and maintenance of the control equipment used to comply with the particulate standard. A time exemption is included in the visible emission standard to accommodate higher opacities caused by periodic bag shaking. The proposed standards require the equivalent of DA acid plant control for sintering machines, electric furnaces, and converters.

Environmental Effects

The SO_2 control systems used to comply with the proposed standards will produce large quantities of sulfur-bearing materials, such as sulfuric acid and liquid sulfur dioxide. During the development of the proposed standards, the industry expressed concern that large quantities of sulfuric acid will not be marketable, and will require neutralization and subsequent disposal. At this time, all existing smelters with acid plants appear to have developed markets for acid, and the indications are that there will be an increasing demand for more acid over the next few years. The potential environmental effects of acid disposal, as well as the disposal of sulfates derived from scrubbing systems, involve land and water pollution. Costs for the neutralization and disposal of sulfuric acid were calculated and taken into account in setting the proposed emission limits. The background information report contains a detailed discussion of these potential secondary effects of the proposed standards. It is the judgment of the Administrator that the potential adverse environmental effects of the proposed standards on land and water are less than the effects which would result if the controlled sulfur dioxide were discharged into the atmosphere.

Test Methods

The proposed standards require that performance tests be conducted and in addition that SO_2 emissions be continuously measured with continuous monitors for each affected facility subject to an SO_2 standard. Method 12 contains performance specifications for the required continuous SO_2 monitors and prescribes the method for demonstrating monitors on each individual emission source. Except during performance tests, the continuous SO_2 data are not intended to determine compliance with the proposed standards, but to provide a day-to-day indication of proper operation and maintenance of the process and emission control equipment. Compliance with the SO_2 standards is determined only by a performance test, conducted in accordance with the provisions of § 60.8—Performance tests, and with the test methods and procedures contained in each applicable subpart. The reference test method for performance tests is a continuous SO_2 monitor demonstrated by Method 12.

ENERGY REQUIREMENTS

The energy requirements of these proposed standards have been evaluated. The power required to control all new primary copper, lead and zinc smelters constructed by 1980 to comply with the proposed standards is 48.5 million kilowatt-hours per year which is equivalent to about 76,000 barrels per year of Number 6 fuel oil; relative to typical State implementation plan requirements for primary copper, lead, and zinc smelters, the incremental power required by the proposed standards is 4.5 million kilowatt-hours per year, which is equivalent to about 7,000 barrels per year of Number 6 fuel oil. This indicates that the proposed standards will have a minor impact on the imbalance between national energy demand and domestic supply.

The proposed standard for primary copper smelters will probably result in a change in the basic process used to smelt copper. The optional smelting processes are flash furnaces and electric furnaces. A flash smelter which meets the proposed standard will require approximately 25 percent less overall energy utilization than a conventional uncontrolled reverberatory furnace smelter. The overall energy requirements of an electric furnace smelter controlled to meet the proposed standard are roughly comparable to those of a reverberatory furnace smelter with a 20 to 30 percent lower level of control.

The power requirements of the proposed standards are generated by the use of fans or pumps to circulate exhaust gases or scrubbing liquids through the control devices. The proposed standards do not require the direct consumption of appreciable quantities of fuel oil or natural gas. The power required to meet the proposed standards represents no more than approximately 5 percent of the total process power requirements of the smelters to be constructed by 1980.

OPACITY STANDARDS

The proper use of and test methods for opacity standards are presently being reconsidered by the Agency in response to remands from the United States Court of Appeals for the District of Columbia Circuit in Portland Cement Ass'n v. Ruckelshaus, 486 F. 2d 375 (1973), and Essex Chemical Corp. v. Ruckelshaus, 486 F. 2d 427 (1973). The response to the remand in the Portland Cement case should be completed shortly. At that time, the Agency will promulgate or propose such revisions of its opacity standards or test methods as it deems necessary or desirable.

This notice of proposed rulemaking is issued under the authority of sections 111 and 114 of the Clean Air Act, as amended (42 U.S.C. 1857c-6 and 9).

JOHN QUARLES,
Acting Administrator.

OCTOBER 4, 1974.

It is proposed to amend Part 60 of Chapter 1, title 40 of the Code of Federal Regulations, by adding new subparts, P, Q and R, and by adding Method 12 to Appendix A as follows:

Subpart P—Standards of Performance for Primary Copper Smelters

Sec.
60.160 Applicability and designation of affected facility.
60.161 Definitions.
60.162 Standard for particulate matter.
60.163 Standard for sulfur dioxide.
60.164 Standard for visible emissions.
60.165 Emission monitoring.
60.166 Test methods and procedures.

Subpart Q—Standards of Performance for Primary Zinc Smelters

60.170 Applicability and designation of affected facility.
60.171 Definitions.
60.172 Standard for particulate matter.
60.173 Standard for sulfur dioxide.
60.174 Standard for visible emissions.
60.175 Emission monitoring.
60.176 Test methods and procedures.

Subpart R—Standards of Performance for Primary Lead Smelters

60.180 Applicability and designation of affected facility.
60.181 Definitions.
60.182 Standard for particulate matter.
60.183 Standard for sulfur dioxide.
60.184 Standard for visible emissions.
60.185 Emission monitoring.
60.186 Test methods and procedures.

APPENDIX A—REFERENCE METHODS

Method 12—Determination of sulfur dioxide emissions from stationary sources by continuous monitors.

AUTHORITY: Secs. 111, 114, Pub. L. 91-604 (42 U.S.C. 1857(c)(6) and (9)).

Subpart P—Standards of Performance for Primary Copper Smelters

§ 60.160 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary copper smelters: Dryer, roaster, smelting furnace, and copper converter.

§ 60.161 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Copper converter" means any vessel to which copper matte is charged and oxidized to copper.

(b) "Dryer" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a portion of the moisture from the charge, provided less than 5 percent of the sulfur contained in the charge is eliminated in the facility.

(c) "Primary copper smelter" means any installation engaged in the production, or any intermediate process in the production, of copper from copper sulfide ore concentrates through the use of pyrometallurgical techniques.

(d) "Reverberatory smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided primarily by combustion of a fossil fuel.

(e) "Roaster" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (5 percent or more) of the sulfur contained in the charge.

(f) "Smelting" means processing techniques for the melting of a copper sulfide ore concentrate or calcine charge leading to the formation of separate layers of molten slag, molten copper, and/or copper matte.

(g) "Smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided by an electric current, rapid oxidation of a portion of the sulfur contained in the concentrate as it passes through an oxidizing atmosphere, or the combustion of a fossil fuel.

(h) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.162 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.163 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster, smelting furnace, or copper converter any gases which contain sulfur dioxide in excess of 0.065 percent by volume, except as provided in paragraph (b) of this section.

(b) Any physical or operational change to any existing reverberatory smelting furnace which results in an increase in sulfur dioxide emission rate from such furnace shall not be considered a modification to such furnace provided the combined total rate of sulfur dioxide emissions discharged into the atmosphere from all existing and affected facilities at the primary copper smelter does not increase. The baseline sulfur dioxide emission rate shall be that allowed under implementation plans approved or promulgated under 40 CFR Part 52.

§ 60.164 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any visible emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner

or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.163, any visible emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirement of paragraph (a) or (b) of this section, such failure shall not be a violation of this section.

§ 60.165 Emission monitoring.

(a) The owner or operator of any primary copper smelter subject to the provisions of this subpart shall install, calibrate, maintain, and operate measurement systems as follows:

(1) A photoelectric or other type smoke detector and recorder to continuously monitor and record the opacity of gases discharged into the atmosphere from any dryer.

(2) An instrument for continuously monitoring and recording sulfur dioxide emissions subject to § 60.163. For the purpose of this subparagraph, "continuous monitoring" means the sampling, analyzing and recording of at least one measurement of sulfur dioxide concentration, from the effluent of the emission control system serving each roaster, smelting furnace, or copper converter, in each 15-minute period.

(b) The measurement system installed and used pursuant to paragraph (a)(1) of this section shall meet specifications prescribed by the Administrator. The measurement system installed and used pursuant to paragraph (a)(2) of this section shall be demonstrated in accordance with the specification test procedures prescribed in Method 12 in Appendix A to this part to meet the measurement system performance specifications also prescribed in Method 12.

(c) The Administrator shall receive notification postmarked not less than 2 weeks in advance of the start of the field test period required in Method 12 to afford the Administrator the opportunity to have an observer present.

(d) Emissions shall be monitored by sampling gases discharged from the emission control system. The sampling point for sulfur dioxide emissions subject to § 60.163 shall be in the duct at the centroid of the cross section if the cross sectional area is less than 4.6 m^2 (49.496 ft^2) or at a point no closer to the wall than 1.0 m (3.281 ft) if the cross sectional area is 4.6 m^2 (49.496 ft^2) or more.

(e) The measurement system installed and used pursuant to this section shall be subjected to the manufacturer's recommended zero and span adjustment at least once daily unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. Minimum procedures for non-extractive monitoring systems shall include upscale adjustment using a certified calibration gas cell or a test cell which is optically equivalent to a known gas concentration.

(f) Six-hour average sulfur dioxide concentrations shall be calculated in accordance with § 60.166(c), and recorded daily, for four consecutive 6-hour periods of each operating day.

(g) For the purpose of reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) *Opacity.* All hourly periods in which the opacity of the gases discharged into the atmosphere from any dryer subject to § 60.164(a) exceeds 20 percent for more than 2 minutes.

(2) *Sulfur dioxide.* All 6-hourly periods, as described in paragraph (f) of this section and in § 60.166(c), during which the average sulfur dioxide concentration in the gases discharged into the atmosphere from any affected facility exceeds the limit set forth in § 60.163.

§ 60.166 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.162 and 60.163 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis, and

(5) Method 12 for the concentration of sulfur dioxide.

(b) For Method 5, the sampling time for each run shall be at least 120 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) For Method 12, sulfur dioxide concentrations shall be determined using the continuous measurement system installed, calibrated, maintained, and operated in accordance with § 60.165(a), (b), (d), and (e). One continuous 6-hour sample shall constitute one run. Six-hour average concentrations of sulfur dioxide shall be calculated as follows:

(1) Divide the 6-hour period into twenty-four 15-minute segments.

(2) Determine a sulfur dioxide concentration measurement for each 15-minute period. This measurement may be obtained either by continuous integration of all measurements (from the specified affected facility) recorded during the 15-minute period or from the arithmetic average of any number of concentration readings equally spaced over the 15 minutes. In the latter case, the same number of concentration readings shall be taken in each 15-minute period and shall be similarly spaced within each 15-minute period.

(3) Calculate the arithmetic average of all 24 concentration measurements.

Subpart Q—Standards of Performance for Primary Zinc Smelters

§ 60.170 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary zinc smelters: roaster and sintering machine.

§ 60.171 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary zinc smelter" means any installation engaged in the production, or any intermediate process in the production, of zinc or zinc oxide from zinc sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Roaster" means any facility in which a zinc sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (10 percent or more) of the sulfur contained in the charge.

(c) "Sintering machine" means any furnace in which calcines are heated in the presence of air to agglomerate the calcines into a hard porous mass called "sinter."

(d) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.172 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.173 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster any gases which contain sulfur dioxide in excess of 0.065 percent by volume.

§ 60.174 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any visible emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in

§ 60.173, any visible emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraph (a) or (b) of this section, such failure shall not be a violation of this section.

§ 60.175 Emission monitoring.

(a) The owner or operator of any primary zinc smelter subject to the provisions of this subpart shall install, calibrate, maintain, and operate measurement systems as follows:

(1) A photoelectric or other type smoke detector and recorder to continuously monitor and record the opacity of gases discharged into the atmosphere from any sintering machine.

(2) An instrument for continuously monitoring and recording the concentration of sulfur dioxide in gases discharged into the atmosphere from any roaster. For the purpose of this subparagraph, "continuous monitoring" means the sampling, analyzing and recording of at least one measurement of sulfur dioxide concentration in each 15-minute period.

(b) The measurement system installed and used pursuant to paragraph (a)(1) of this section shall meet specifications prescribed by the Administrator. The measurement system installed and used pursuant to paragraph (a)(2) of this section shall be demonstrated in accordance with the specification test procedures prescribed in Method 12 in Appendix A to this part to meet the measurement system performance specifications also prescribed in Method 12.

(c) The Administrator shall receive notification postmarked not less than 2 weeks in advance of the start of the field test period required in Method 12 to afford the Administrator the opportunity to have an observer present.

(d) Emissions shall be monitored by sampling gases discharged from the emission control systems. The sampling point for sulfur dioxide emissions subject to § 60.173 shall be in the duct at the centroid of the cross section if the cross sectional area is less than 4.6 m^2 (49.496 ft^2) or at a point no closer to the wall than 1.0 m (3.281 ft) if the cross sectional area is 4.6 m^2 (49.496 ft^2) or more.

(e) The measurement systems installed and used pursuant to this section shall be subjected to the manufacturer's recommended zero and span adjustment at least once daily unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. Minimum procedures for nonextractive monitoring systems shall include upscale adjustment using a certified calibration gas cell or a test cell which is optically equivalent to a known gas concentration.

(f) Two-hour average sulfur dioxide concentrations shall be calculated in accordance with § 60.176(c), and recorded daily, for 12 consecutive 2-hour periods of each operating day.

(g) For the purpose of reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) *Opacity.* All hourly periods in which the opacity of the gases discharged into the atmosphere from any sintering machine subject to § 60.174(a) exceeds 20 percent for more than 2 minutes.

(2) *Sulfur dioxide.* All 2-hourly periods, as described in paragraph (f) of this section and in § 60.176(c), during which the average sulfur dioxide concentration in the gases discharged into the atmosphere from any roaster exceeds the limit set forth in § 60.173.

§ 60.176 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.172 and 60.173 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis, and

(5) Method 12 for the concentration of sulfur dioxide.

(b) For Method 5, the sampling time for each run shall be at least 120 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) For Method 12, sulfur dioxide concentrations shall be determined using the continuous measurement system installed, calibrated, maintained, and operated in accordance with § 60.175 (a), (b), (d), and (e). One continuous 2-hour sample shall constitute one run. Two-hour average concentrations of sulfur dioxide shall be calculated as follows:

(1) Divide the 2-hour period into eight 15-minute segments.

(2) Determine a sulfur dioxide concentration measurement for each 15-minute period. This measurement may be obtained either by continuous integration of all measurements (from the specified affected facility) recorded during the 15-minute period or from the arithmetic average of any number of concentration readings equally spaced over the 15 minutes. In the latter case, the same number of concentration readings shall be taken in each 15-minute period and shall be similarly spaced within each 15-minute period.

(3) Calculate the arithmetic average of all eight concentration measurements.

Subpart R—Standards of Performance for Primary Lead Smelters

§ 60.180 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary lead smelters: sintering machine, sintering machine discharge end, blast furnace, dross reverberatory furnace, electric smelting furnace, and converter.

§ 60.181 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Blast furnace" means any reduction furnace to which sinter is charged and which forms separate layers of molten slag and lead bullion.

(b) "Converter" means any vessel to which lead concentrate or bullion is charged and refined.

(c) "Dross reverberatory furnace" means any furnace used for the removal or refining of impurities from lead bullion.

(d) "Electric smelting furnace" means any furnace in which the heat necessary for smelting of the lead sulfide ore concentrate charge is generated by passing an electric current through a portion of the molten mass in the furnace.

(e) "Primary lead smelter" means any installation engaged in the production, or any intermediate process in the production, of lead from lead sulfide ore concentrates through the use of pyrometallurgical techniques.

(f) "Sinter bed" means the lead sulfide ore concentrate charge within a sintering machine.

(g) "Sintering machine" means any furnace in which a lead sulfide ore concentrate charge is heated in the presence of air to eliminate sulfur contained in the charge and to agglomerate the charge into a hard porous mass called "sinter."

(h) "Sintering machine discharge end" means any apparatus which receives sinter as it is discharged from the conveying grate of a sintering machine.

(i) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.182 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.183 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine (provided such gases pass through the sinter bed), electric smelting furnace, or converter any gases which contain sulfur dioxide in excess of 0.065 percent by volume.

§ 60.184 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any visible

emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.183, any visible emissions which exhibit 20 percent or greater opacity, except for 2 minutes in any one hour.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraph (a) or (b) of this section, such failure shall not be a violation of this section.

§ 60.185 Emission monitoring.

(a) The owner or operator of any primary lead smelter subject to the provisions of this subpart shall install, calibrate, maintain, and operate measurement systems as follows:

(1) A photoelectric or other type smoke detector and recorder to continuously monitor and record the opacity of gases discharged into the atmosphere from any affected facility subject to § 60.184(a).

(2) An instrument for continuously monitoring and recording the concentration of sulfur dioxide in gases discharged into the atmosphere from any affected facility subject to § 60.183(a). For the purpose of this subparagraph, "continuous monitoring" means the sampling, analyzing and recording of at least one measurement of sulfur dioxide concentration in each 15-minute period.

(b) The measurement system installed and used pursuant to paragraph (a) (1) of this section shall meet specifications prescribed by the Administrator. The measurement system installed and used pursuant to paragraph (a) (2) of this section shall be demonstrated in accordance with the specification test procedures prescribed in Method 12 in Appendix A to this part to meet the measurement system performance specifications also prescribed in Method 12.

(c) The Administrator shall receive notification postmarked not less than 2 weeks in advance of the start of the field test period required in Method 12 to afford the Administrator the opportunity to have an observer present.

(d) Emissions shall be monitored by sampling gases discharged from the emission control systems. The sampling point for sulfur dioxide emissions subject to § 60.183 shall be in the duct at the centroid of the cross section if the cross sectional area is less than 4.6 m^2 (49.496 ft^2) or a a point no closer to the wall than 1.0 m (3.281 ft) if the cross sectional area is 4.6 m^2 (49.496 ft^2) or more.

(e) The measurement systems installed and used pursuant to this section shall be subjected to the manufacturer's recommended zero and span adjustment at least once daily unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. Minimum procedures for non-extractive monitoring systems shall include upscale adjustment using a certified calibration gas cell or a test cell which is optically equivalent to a known gas concentration.

(f) Two-hour average sulfur dioxide concentrations shall be calculated in accordance with § 60.186(c), and recorded daily, for 12 consecutive 2-hour periods of each operating day.

(g) For the purpose of reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) *Opacity.* All hourly periods in which the opacity of the gases discharged into the atmosphere from any affected facility subject to § 60.184(a) exceeds 20 percent for more than 2 minutes.

(2) *Sulfur dioxide.* All 2-hourly periods, as described in paragraph (f) of this section and in § 60.186(c), during which the average sulfur dioxide concentration in the gases discharged into the atmosphere from any affected facility exceeds the limit set forth in § 60.183.

§ 60.186 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.182 and 60.183 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate.

(4) Method 3 for gas analysis, and

(5) Method 12 for the concentration of sulfur dioxide.

(b) For Method 5, the sampling time for each run shall be at least 120 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) For Method 12, sulfur dioxide concentrations shall be determined using the continuous measurement system installed, calibrated, maintained, and operated in accordance with § 60.185(a), (b), (d), and (e). One continuous 2-hour sample shall constitute one run. Two-hour average concentrations of sulfur dioxide shall be calculated as follows:

(1) Divide the 2-hour period into eight 15-minute segments.

(2) Determine a sulfur dioxide concentration measurement for each 15-minute period. This measurement may be obtained either by continuous integration of all measurements (from the specified affected facility) recorded during the 15-minute period or from the arithmetic average of any number of concentration readings equally spaced over the 15 minutes. In the latter case, the same number of concentration readings shall be taken in each 15-minute period and shall be similarly spaced within each 15-minute period.

(3) Calculate the arithmetic average of all eight concentration measurements.

2. Appendix A is amended by adding Method 12 as follows:

METHOD 12. DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES BY CONTINUOUS MONITORS

1. Principle and Applicability. 1.1 Principle. Gases are continuously sampled in the stack emissions and analyzed for sulfur dioxide by a continuously operating emission measurement system. Sampling may include either the extractive or non-extractive (in situ) approach.

1.2 Applicability. This method is applicable to the instrument systems specified by subparts for continuously monitoring sulfur dioxide emissions. Specifications for continuous measurement of sulfur dioxide are given in terms of performance specifications. Test procedures are given to determine the capability of the measurement systems to conform to the performance specifications prior to approving the systems installed by an affected facility.

2. Apparatus. 2.1 Calibration Gas Mixture. Mixture of a known concentration of sulfur dioxide in oxygen-free nitrogen. Nominal concentrations of 50 percent and 90 percent of span are recommended. The 90 percent gas mixture is to be used to set and to check the span and is referred to as the span gas. The gas mixtures shall be analyzed by Method 6 or 8 within 2 weeks prior to use, or demonstrated to be accurate and stable by an alternative method subject to approval of the Administrator.

2.2 Zero Gas. A gas containing less than 1 ppm of sulfur dioxide.

2.3 Equipment for measurement of the sulfur dioxide concentration using Method 6 or Method 8.

2.4 Chart Recorder. Analog chart recorder, input voltage range compatible with analyzer system output.

2.5 Continuous measurement system for SO_2.

3. Definitions. 3.1 Measurement System. The total equipment required for the determination of a sulfur dioxide concentration in a given source effluent. The system consists of three major subsystems:

3.1.1 Sampling Interface—That portion of the measurement system that performs one or more of the following operations: delineation, acquisition, transportation, and conditioning of a sample of the source effluent or protection of the analyzer from the hostile aspects of the sample or source environment.

3.1.2 Analyzer—That portion of the measurement system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder—That portion of the measurement system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of sulfur dioxide concentration at which the measurement system is set to produce the maximum data display output. For the purposes of this method, the span shall be set at a sulfur dioxide concentration of 2000 ppm by volume except as specified under 5.2.

3.3 Accuracy (Relative). The degree of correctness with which the measurement system yields the value of gas concentration of a sample relative to the value given by a defined reference method. This accuracy is expressed in terms of error, which is the difference between the paired concentration measurements expressed as a percentage of the mean reference value.

3.4 Calibration Error. The difference between the pollutant concentration indicated

by the measurement system and the known concentration of the test gas mixture.

3.5 Zero Drift. The change in measurement system output over a stated period of time of normal continuous operation when the pollutant concentration at the time for the measurement is zero.

3.6 Calibration Drift. The change in measurement system output over a stated time period of normal continuous operation when the pollutant concentration at the time of the measurement is the same known upscale value.

3.7 Response Time. The time interval from a step change in pollutant concentration at the input to the measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the measurement system data presentation device.

3.8 Operational Period. A minimum period of time over which a measurement system is expected to operate within certain performance specifications without unscheduled maintenance, repair or adjustment.

4. Measurement System Performance Specifications.

A measurement system shall meet the performance specifications in Table 12–1 to be considered acceptable under this method.

TABLE 12–1. PERFORMANCE SPECIFICATIONS

Parameter	*Specification*
1. Accuracy [1]	≤20% of reference mean value.
2. Calibration error [1]	≤5% of each (50 percent, 90 percent) calibration gas mixture value.
3. Zero drift (2-hour) [1]	≤2% of emission standard.
4. Zero drift (24-hour) [1]	≤4% of emission standard.
5. Calibration drift (2-hour) [1]	≤2% of emission standard.
6. Calibration drift (24-hour) [1]	≤5% of emission standard.
7. Response time	15 minutes maximum.
8. Operational period	168 hours minimum.

[1] Expressed as sum of absolute mean value plus 95 percent confidence interval of a series of tests.

5.2 Field Test for Accuracy (Relative), Zero Drift, and Calibration Drift. Install and operate the measurement system in accordance with the manufacturer's written instructions and drawings as follows:

5.2.1 Conditioning Period—Offset the zero setting at least 10 percent of span so that negative zero drift can be quantified. Operate the system for an initial 168-hour conditioning period in a normal operational manner.

5.2.2 Operational Test Period—Operate the system for an additional 168-hour period. The system shall be monitoring the source effluent at all times when not being zeroed, calibrated, or backpurged.

5.2.2.1 Field Test for Accuracy (Relative). The analyzer output for this test shall be maintained between 20 percent or 90 percent of full scale. Depending upon the source emission concentration, this may require setting the analyzer span at a concentration below 2000 ppm. It is recommended that a calibrated gas mixture be used to verify the span setting utilized. During this 168-hour test period, make a minimum of nine (9) SO_2 concentration measurements using Method 8 with a sampling period of one hour. Isokinetic sampling and analysis for SO_2 and H_2SO_4 mist are not required. For measurement systems employing extractive sampling, it is recommended that the measurement system and the Method 8 probe tips be placed adjacent to each other in the duct. One test will consist of one sample. Record the test data and measurement system concentrations on the example sheet shown in Figure 12–3.

5. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 4:

5.1 Calibration test.

5.1.1 Analyze each calibration gas mixture (50 percent, 90 percent) for sulfur dioxide as required by paragraph 2.1 and record the results on the example sheet shown in Figure 12–1. This step may be omitted for non-extractive monitors where dynamic calibration gas mixtures are not used (see 5.1.2).

5.1.2 Set up and calibrate the complete measurement system according to the manufacturer's written instructions. This may be accomplished either in the laboratory or in the field. Make a series of five non-consecutive readings with span gas mixtures alternately at each concentration (e.g., 50%, 90%, 50%, 90%, 50%). For non-extractive measurement systems, this test may be performed using procedures specified by the manufacturer and two or more calibration gases whose concentrations are certified by the manufacturer and differ by a factor of two or more. Convert the measurement system output readings to ppm and record the results on the example sheet shown in Figure 12–2.

5.2.2.2 Field Test for Zero Drift and Calibration Drift. Determine the values given by zero and span gas pollutant concentrations at 2-hour intervals until 15 sets of data are obtained. For nonextractive measurement systems the zero and span values may be determined by producing electrically or mechanically a zero condition and by inserting a certified calibration gas concentration equivalent to not less than 300 ppm into the measurement system. Record these readings on the example sheet shown in Figure 12–4. These 2-hour periods need not be consecutive but may not overlap. The zero and span determinations to be made under this paragraph may be made concurrent with the tests under 5.2.2.1. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention or initiation are allowable at any time. During the entire 168-hour operational test period, record on the example sheet shown in Figure 12–5 the values given by zero and span gas SO_2 concentrations before and after adjustment at 24-hour intervals.

5.3 Field Test for Response Time.

5.3.1 Use the entire measurement system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one pollutant source (stack), repeat this test for each sampling point.

5.3.2 Introduce zero gas into the measurement system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of sulfur dioxide at 70 to 90 percent of span. Record the time from concentration switching to final stable response. After the system response has stabilized at the upper level, switch quickly to a zero concentration of pollutant gas. Record the time from concentration switching to final stable response. For non-extractive monitors, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. Record the results of each test on the example sheet shown in Figure 12–6.

6. Calculations, Data Analysis and Reporting.

6.1 Procedure for determination of mean values and confidence intervals.

6.1.1 The mean value of a data set is calculated according to equation 12–1.

EQUATION 12–1

$$\bar{x}=\frac{1}{n}\sum_{i=1}^{n}x_i$$

where:

x_i = individual values,
Σ = sum of the individual values,
$\bar{x}$ = mean value, and
n = number of data points.

6.1.2. The 95 percent confidence interval (two-sided) is calculated according to equation 12–2.

EQUATION 12–2

$$\text{C.I.}_{95}=\frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n(\Sigma x_i^2)-(\Sigma x_i)^2}$$

where
Σx_i = sum of all data points,
$t_{.975}$ = $t_{1-\alpha/2}$, and
C.I._{95} = 95 percent confidence interval estimate of the mean value.

VALUES FOR $t_{.975}$

n	$t_{.975}$	n	$t_{.975}$	n	$t_{.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

6.2 Data Analysis and Reporting.

6.2.1 Accuracy (Relative)—For each of the nine reference method testing periods, determine the average sulfur dioxide concentration reported by the continuous measurement system. These average concentrations shall be determined from the measurement system data recorded under 5.2.2.1 by integrating the pollutant concentrations over each of the time intervals concurrent with each reference method test, then dividing by the cumulative time of each applicable reference method testing period. Before proceeding to the next step, determine the basis (wet or dry) of the measurement system data and reference method test data concentrations. If the bases are not consistent, apply a moisture correction to either the reference method concentrations or the measurement system concentrations, as appropriate. Determine the correction factor by moisture tests concurrent with the reference method testing periods. Report the moisture test method and the correction procedure employed. For each of the nine test runs, subtract the respective Method 6 or Method 8 test concentrations from the continuous monitoring system average concentrations. Using these data, compute the mean difference and the 95 percent confidence interval using equations 12–1 and 12–2. Accuracy is reported as the sum of the

absolute value of the mean difference and the 95 percent confidence interval expressed as a percentage of the mean reference method value. Use the example sheet shown in Figure 12–3.

6.2.2 Calibration Error—Using the data from paragraph 5.1, subtract the measured pollutant concentration determined under paragraph 5.1.1 (Figure 12–1) from the value shown by the measurement system for each of the five readings at each concentration measured under 5.1.2 (Figure 12–2). Calculate the mean of these difference values and the 95 percent confidence intervals according to equations 12–1 and 12–2. Report the calibration error (the sum of the absolute value of the mean difference and the 95 percent confidence interval) as a percentage of each respective calibration gas concentration. Use example sheet shown in Figure 12–2.

6.2.3 Zero Drift (2-hour)—Using the zero concentration values measured each 2 hours during the field test, calculate the differences between consecutive 2-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 12–1 and 12–2. Report the zero drift as the sum of the absolute mean value and the confidence interval as a percentage of the emission standard. Use example sheet shown in Figure 12–4.

6.2.4 Zero Drift (24-hour)—Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 12–1 and 12–2. Report the zero drift (the sum of the absolute mean and confidence interval) as a percentage of the emission standard. Use example sheet shown in Figure 12–5.

6.2.5 Calibration Drift (2-hour)—Using the calibration values obtained at 2-hour intervals during the field test, calculate the differences between consecutive 2-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that 2-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 12–1 and 12–2. Do not use the differences between non-consecutive readings. Report the calibration drift (the sum of the absolute mean and confidence interval) as a percentage of the emission standard. Use the example sheet shown in Figure 12–4.

6.2.6 Calibration Drift (24-hour)—Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 12–1 and 12–2. Report the sum of the absolute mean and confidence interval as a percentage of the emission standard. Use the example sheet shown in Figure 12–5.

6.2.7 Response Time—Using the results under paragraph 5.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Use the example sheet shown in Figure 12–6.

6.2.8 Operational Test Period—During the 168-hour performance and operational test period, the measurement system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the operation and maintenance manuals as routine and expected during a 1-week period. If the measurement system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the measurement to meet this requirement shall call for a repetition of the 168-hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the 1-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

7. References

7.1 *Monitoring Instrumentation for the Measurement of Sulfur Dioxide in Stationary Source Emissions,* Environmental Protection Agency, Research Triangle Park, N.C., February 1973.

7.2 *Instrumentation for the Determination of Nitrogen Oxides Content of Stationary Source Emissions,* Environmental Protection Agency, Research Triangle Park, N.C., Volume 1, APTD–0847, October 1971; Volume 2, APTD–0942, January 1972.

7.3 *Experimental Statistics,* Department of Commerce, Handbook 91, 1963, p. 3–31 paragraphs 3–3.1.4.

7.4 *Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions,* Environmental Protection Agency, Research Triangle Park, N.C., EPA–650/2–74–013, January 1974.

FIGURE 12–1.—*Analysis of calibration gas mixtures*

Reference Method Used____

Date _____

Mid-Range Calibration Gas Mixture:

Sample 1 _____ ppm
Sample 2 _____ ppm
Sample 3 _____ ppm
Average _____ ppm

High-Range (span) Calibration Gas Mixture:

Sample 1 _____ ppm
Sample 2 _____ ppm
Sample 3 _____ ppm
Average _____ ppm

FIGURE 12–2.—*Calibration error determination*

Calibration gas mixture data (from fig. 12–1)

Mid (50 percent) ____ parts per million High (90 percent) ____ parts per million

[In parts per million]

Run no.	Calibration gas concentration	Measurement system reading	Differences [1]
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

	Mid	*High*
Mean difference		
Confidence interval (±)		
Calibration error (percent) = $\frac{\text{mean difference [2]} + \text{C.I.}}{\text{average calibration gas concentration}} \times 100$		

[1] Calibration gas concentration—measurement system reading.
[2] Absolute value.

FIGURE 12–3.—*Accuracy determination*

Date and time	Test No.	Reference method samples	Analyzer 1-hour average [1] (parts per million)	Difference [2] (parts per million)
[1]	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			

Mean difference=_____ parts per million.
95 percent confidence interval=±_____ parts per million.
Mean reference method value=_____ parts per million.

$$\text{Accuracy} = \frac{\text{mean difference (absolute value)} + \text{95 percent confidence interval}}{\text{mean reference method value}} \times 100 = _____ \text{ percent.}$$

[1] Explain method used to determine average.
[2] Difference=the 1-hour average minus the reference method average.

FIGURE 12-4.—*Zero and calibration drift (2-hour)*

Date	Time		Data set No.	Zero reading	Zero drift (Δzero)	Span reading	(Δspan)	Calibration drift (Δspan—zero)
	Begin	End						
			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					
			11					
			12					
			13					
			14					
			15					

Zero drift = [mean zero drift [1] _____ + C.I. (zero) _____] ÷ [emission standard] × 100 = _____.
Calibration drift = [mean span drift [1] _____ + C.I. (span) _____] ÷[emission standard] × 100 = _____.

[1] Absolute value.

FIGURE 12-5.—*Zero and calibration drift (24-hour)*

Date and time	Zero reading	Zero drift (Δzero)	Span reading (after zero adjustment)	Calibration drift (Δspan)

Zero drift=[Mean zero drift [1] _____ + C.I. (zero) _____] ÷ [emission standard] × 100 = _____.
Calibration drift = [mean span drift [1] _____ + C.I. (span _____] ÷ [emission standard] × 100 = _____.

[1] Absolute value.

FIGURE 12-6.—*Response time*

Date of test _____.
Span gas concentration _____ parts per million.
Analyzer span setting _____ ppm.
Upscale:
1 _____ seconds.
2 _____ seconds.
3 _____ seconds.
Average upscale response _____ seconds.
Downscale:
1 _____ seconds.
2 _____ seconds.
3 _____ seconds.
Average downscale response _____ seconds.
System response time=slower time= _____ seconds.
Percent deviation from slowest time=

$$\frac{\text{average upscale minus average downscale} \times 100 \text{ percent}}{\text{slower time}}$$

[FR Doc.74-23834 Filed 10-15-74;8:45 am]

Just Released

CODE OF FEDERAL REGULATIONS

(Revised as of July 1, 1974)

Title 29—Labor (Parts 500–1899) ---------- $5.50

Title 33—Navigation and Navigable Waters (Parts 1–199) ---------- 4.85

Title 41—Public Contracts and Property Management (Chapters 1–2) ---------- 5.20

[*A Cumulative checklist of CFR issuances for 1974 appears in the first issue of the Federal Register each month under Title 1*]

**Order from Superintendent of Documents,
United States Government Printing Office,
Washington, D.C. 20402**